

CLAIMS

What is Claimed is:

1. A fiber material, comprising:
a first layer of directionally aligned fibers; and
5 a second layer of randomly dispersed fibers dispersed over the first layer.
2. A fiber material according to claim 1, wherein the first layer includes fibers directionally aligned in a plurality of linear formations.
- 10 3. A fiber material according to claim 2, wherein the plurality of linear formations comprises a plurality of crossing linear formations.
4. A fiber material according to claim 1, wherein the fibers are selected from the group consisting of: glass fibers, synthetic polymer fibers, ceramic and inorganic fibers, natural
15 fibers, cellulosic fibers, and mixtures of any or all thereof.
5. A fiber material according to claim 1, wherein each of the fibers comprises a diameter ranging from about 0.00001 inches to about 0.0300 inches.
- 20 6. A fiber material according to claim 1, wherein each of the fibers comprises a length ranging from about 0.10 inches to about 1.5 inches.

7. A fiber material according to claim 1, further comprising a binder material distributed among the fibers within the first and second layers.

5 8. A fiber material according to claim 7, wherein the fiber material comprises about 5-30% binder material by weight.

9. A fiber material according to claim 7, wherein the binder material comprises an organic compound.

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10. A fiber material according to claim 9, wherein the organic compound is selected from the group consisting of acrylic latex, urea-formaldehyde, SBR latex, acrylic emulsions, and mixtures thereof.

15 11. A fiber material according to claim 1, wherein the first layer comprises a thickness of about 50% of the total thickness of the fiber material.

12. A fiber material according to claim 1, wherein the fiber material has a tear-strength under the Elmendorf Tear Test greater than a single layer fiber material having a

20 substantially equal total thickness and comprising only randomly dispersed similar fibers.

13. A fiber material according to claim 12, wherein the fiber material has a total weight less than a total weight of the single layer fiber material.

14. A fiber material, comprising:

5 a first plurality of fibers horizontally dispersed in one or more predetermined directions;

a second plurality of fibers horizontally dispersed over the first plurality of fibers in random directions; and

10 binding material binding the first and second pluralities of fibers in their respective directions.

15. A fiber material according to claim 14, wherein the fibers are selected from the group consisting of: glass fibers, synthetic polymer fibers, ceramic and inorganic fibers, natural fibers, cellulosic fibers, and mixtures of any or all thereof.

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16. A fiber material according to claim 14, wherein each of the fibers comprises a diameter ranging from about 0.00001 inches to about 0.0300 inches.

17. A fiber material according to claim 14, wherein each of the fibers comprises a length
20 ranging from about 0.10 inches to about 1.5 inches.

18. A fiber material according to claim 14, wherein the binding material comprises an organic compound.

19. A fiber material according to claim 18, wherein the organic compound is selected
5 from the group consisting of acrylic latex, urea-formaldehyde, SBR latex, acrylic emulsions, and mixtures thereof.

20. A fiber material according to claim 14, wherein the fibers in the first plurality of
10 fibers are horizontally dispersed in linear formations extending in the one or more predetermined directions.

21. A fiber material according to claim 1, wherein the first plurality of fibers comprises a thickness of about 50% of the total thickness of the fiber material.

15 22. A fiber material according to claim 14, wherein the fiber material has a tear-strength under the Elmendorf Tear Test greater than a single layer fiber material having a substantially equal total thickness and comprising only randomly dispersed similar fibers.

23. A fiber material according to claim 22, wherein the fiber material has a total weight
20 less than a total weight of the single layer fiber material.

24. A fiber material according to claim 14, wherein the first and second pluralities of fibers are both horizontally dispersed to a substantially uniform thickness.

25. A fiber material according to claim 14, wherein the binding material comprises about
5 5% to 30% of a total weight of the fiber material.

26. A method for manufacturing a fiber material, the method comprising:
dispersing a first plurality of fibers horizontally in one or more predetermined
directions; and

10 dispersing a second plurality of fibers horizontally dispersed over the first plurality of
fibers in random directions.

27. A method according to claim 26, further comprising dispersing a first plurality of
fibers horizontally onto a three-dimensional forming wire comprising a screen and vertical
15 protuberances projecting from the screen, a length of the protuberances determining a
thickness of the first plurality of fibers.

28. A method according to claim 26, wherein the length of each of the protuberances
ranges from about 0.005 inches to about 0.375 inches.

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29. A method according to claim 25, further comprising dispersing the first plurality of fibers horizontally in a plurality of linear formations extending in the one or more predetermined directions.
- 5 30. A method according to claim 29, further comprising dispersing the first plurality of fibers horizontally in a plurality of crossing linear formations.
31. A method according to claim 26, wherein the fibers are selected from the group consisting of: glass fibers, synthetic polymer fibers, ceramic and inorganic fibers, natural
10 fibers, cellulosic fibers, and mixtures of any or all thereof.
32. A method according to claim 26, wherein each fiber of the first and second pluralities of fibers comprises a diameter ranging from about 0.00001 inches to about 0.0300 inches.
- 15 33. A method according to claim 26, wherein each fiber of the first and second pluralities of fibers comprises a length ranging from about 0.10 inches to about 1.5 inches.
34. A method according to claim 26, wherein dispersing a first plurality of fibers comprises dispersing a first plurality of fibers comprising a layer having a thickness of about
20 50% of the total thickness of the fiber material.

35. A method according to claim 26, wherein dispersing first and second pluralities of fibers comprises dispersing first and second pluralities of fibers to form a fiber material having a tear-strength under the Elmendorf Tear Test greater than a single layer fiber material having a substantially equal total thickness and comprising only randomly dispersed similar fibers.

36. A method according to claim 35, wherein the fiber material has a total weight less than a total weight of the single layer fiber material.

37. A method according to claim 26, wherein dispersing further comprises dispersing the first and second pluralities of fibers horizontally to a substantially uniform thickness.

38. A method according to claim 26, further comprising binding the first and second pluralities of fibers in their respective directions with a binding material.

39. A method according to claim 38, wherein binding further comprises binding the first and second pluralities of fibers to form a fiber material having about 5-30% binder material by weight.

40. A method according to claim 38, wherein binding further comprises binding with a binder material comprising an organic compound.

41. A method according to claim 40, wherein the organic compound is selected from the group consisting of acrylic latex, urea-formaldehyde, SBR latex, acrylic emulsions, and mixtures thereof.

5 42. A roofing shingle, comprising:

a nonwoven fiber mat, comprising:

a first layer of directionally aligned fibers,

a second layer of randomly dispersed fibers dispersed over the first layer, and

binding material binding the first and second layers of fibers in their

10 respective directions; and

a bituminous material formed over and through the nonwoven fiber mat.

43. A roofing shingle according to claim 42, wherein the first layer of the nonwoven fiber mat includes fibers directionally aligned in a plurality of linear formations.

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44. A roofing shingle according to claim 43, wherein the plurality of linear formations comprises a plurality of crossing linear formations.

45. A roofing shingle according to claim 42, wherein the fibers are selected from the group consisting of: glass fibers, synthetic polymer fibers, ceramic and inorganic fibers, natural fibers, cellulosic fibers, and mixtures of any or all thereof.

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46. A roofing shingle according to claim 42, wherein the nonwoven fiber mat comprises about 5-30% binder material by weight.

47. A roofing shingle according to claim 42, wherein the first layer of the nonwoven fiber
5 mat comprises a thickness of about 50% of the total thickness of the mat.

48. A roofing shingle according to claim 42, wherein the roofing shingle has a tear-
strength under the Elmendorf Tear Test greater than a roofing shingle having a single layer
nonwoven fiber mat with a substantially equal total thickness and comprising only randomly
10 dispersed similar fibers.

49. A roofing shingle according to claim 48, wherein the roofing shingle has a total
weight less than a total weight of the roofing shingle having a single layer nonwoven fiber
mat.

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50. A roofing shingle according to claim 42, further comprising granules formed over and
into an exposed surface of the bituminous material.